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RESEARCH ARTICLE

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The vascular flora of Tarsia (Calabria, southern Italy)

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Abstract

A list of the vascular flora occurring in the municipality of Tarsia (province of Cosenza, Calabria) is provided. The list is based on a bibliographic analysis and on field studies carried out in the years 2018–2025. A total of 618 specific and subspecific taxa are recorded in the study area (including 64 aliens), plus 35 cultivated taxa. *Chenopodium ficifolium* Sm. and *Orobanche cernua* Loefl. are new records for Calabria.

Keywords

Alien species, biodiversity, endemics, floristic data, Italy, phytogeography

Introduction

A flora is a useful source of information for biogeographical, ecological and evolutionary studies (Peruzzi 2018; D'Antraccoli et al. 2022b; Bartolucci et al. 2024), so that floristic inventories are crucial to provide suitable data for decision-making processes in biodiversity conservation and landscape planning, either in urban (Peruzzi et al. 2025) or more natural (Carta et al. 2018; Gestri et al. 2023; Pierini and Peruzzi 2025) areas.

The territory in the municipality of Tarsia (Calabria, southern Italy) has received little attention from botanists in the past, except for the southern portion where the northern shores of Lake Tarsia are located, an artificial basin created in 1959. For this area, considered of low floristic knowledge by Bernardo et al. (2005), only 41 floristic records have been published over time (Crisafulli et al. 2010; Maiorca et al. 2013) before this study.

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The aim of this study is to present a complete and updated floristic inventory of the vascular flora of Tarsia, in the framework of a series of contributions whose goal is to improve the floristic knowledge of Calabria (La Valva and Ricciardi 1978; La Valva 1984; Ballelli and Venanzoni 1993; Maiorca and Spampinato 1994; Bernardo and Maiorca 1996; Maiorca et al. 2002, 2007; Musarella and Tripodi 2004; Maiorca and Puntillo 2009, 2015; Bernardo et al. 2011, 2012; Di Marco et al. 2013; Roma-Marzio et al. 2015; Spampinato et al. 2019; Caruso et al. 2022; Spampinato et al. 2022; Capuano and Caruso 2023; Capuano et al. 2024; Laface et al. 2024; Mauro et al. 2024; Musarella et al. 2024).

Material and methods

Study area

The territory of the municipality of Tarsia (province of Cosenza) covers an area of 48.28 km^2 in northern Calabria, lower Crati Valley, at elevations between 40 and 370 m a.s.l. (Fig. 1). The vegetation of the area reflects a Mediterranean bioclimatic context; a small portion in the northeast belongs to the southern edaphically indifferent series of downy oak (*Quercus virgiliana* (Ten.) Ten., a current synonym of *Q. pubescens* Willd. subsp. *pubescens*); the southern portion bordering the Crati River belongs to the central–southern peninsular hygrophilous geosigmetum of lowland and riparian vegetation; the remaining territory is included in the southern Apennine Tyrrhenian acidophilous series of downy oak (*Q. virgiliana*) (Bernardo et al. 2010a, 2010b). Most of the territory is devoted to agriculture, mainly olive groves and vineyards, with *Citrus* orchards to a much lesser extent. Spontaneous vegetation is therefore confined to a few relict patches, resulting in low environmental variability and high degree of human disturbance.

Methods

Besides the analysis of the few literature sources available (see Introduction), field investigations were carried out in the last 20 years, more intensively in the years 2018–2025. The most significant species were reported during this multi-year research (Puntillo and Peruzzi 2008; Gangale et al. 2010; Peruzzi et al. 2010; Astuti et al. 2015, 2021; Peruzzi et al. 2016; Bartolucci et al. 2017; Roma-Marzio et al. 2018; Galasso et al. 2020, 2021; Laface et al. 2020; Sáez et al. 2022). For the most significant taxa, herbarium specimens (PI, herbarium acronyms follow Thiers 2026) were prepared and/or photographic documentation was produced. In some cases, seeds were collected and deposited in the seed bank of the Botanic Garden and Museum of the University of Pisa. To outline the entire vascular flora, extensive use was made of field observations, all archived and freely accessible in the online database Wikiplantbase #Italia (Peruzzi et al. 2019 onwards). These data were supplemented by information derived from herbarium specimens preserved in CLU, FI, and NAP.

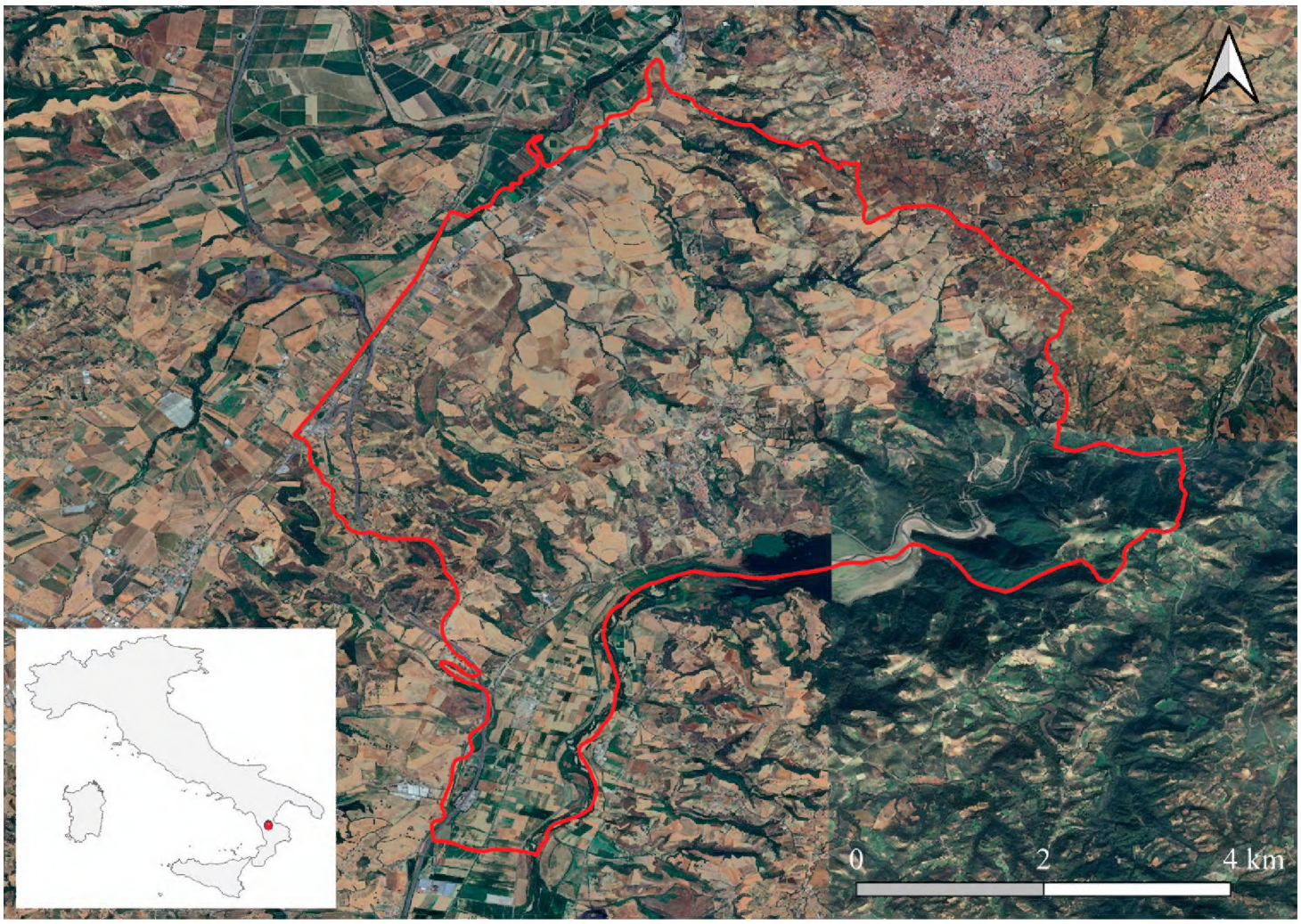

Figure 1. Localisaton and delimitation of the municipality of Tarsia (province of Cosenza, Calabria, southern Italy); the dominance of cultivated and urbanized areas is evident.

Nomenclature and circumscription of the taxa follows Bartolucci et al. (2024), Galasso et al. (2024) and their updates periodically appearing in the Portal to the Flora of Italy (https://dryades.units.it/floritaly/index.php; Martellos et al. 2020). Angiosperm families are arranged according to APG IV (2016). Within families, genera, species and subspecies are listed in alphabetical order. Life forms and chorotypes were attributed according to Pignatti et al. (2017a, 2017b, 2018), not considering casual aliens and cultivated species. We also highlighted those taxa included in the National Red List (Rossi et al. 2013, 2021; Orsenigo et al. 2021). Chorotypes were simplified as follows: Eurosiberian, Eurosiberian-Mediterranean, Mediterranean, wide distribution, Italian endemic, alien, as in Peruzzi (2023). The endemicity status was based on Peruzzi et al. (2014, 2015). The complete dataset assembled for the present study is available in Suppl. material 1.

The expected number (S) of entire and alien taxa occurring in the study area (A) were calculated using Arrhenius' species-area relationship $S = cA^z$, and using the c (241.2 and 10.1 for the entire and alien taxa, respectively) and z (0.281 and 0.404 for entire and alien taxa, respectively) coefficients empirically calculated for the floristic richness of Italy by D'Antraccoli et al. (2024).

At the end of the study, the method proposed by D'Antraccoli et al. (2022a) was applied to obtain a final Map of Relative Floristic Ignorance. This allows a proper planning of possible further floristic investigations of the area. All the floristic records (10,726) available in Peruzzi et al. (2019 onwards) for the province of Cosenza were used.

Results

The complete floristic inventory is reported in the Suppl. material 1. The expected number of species/subspecies was 803, of which 38 aliens. A total of 618 specific and subspecific taxa were documented for the study area, including 64 aliens (21 casual, 25 naturalized, 18 invasive).

The available records for the municipality of Tarsia amount to 6,821, more than 95% of which are based on field observations, the remaining part being constituted by herbarium (148) and photographic (135) documentation. The recorded flora consists of 618 spontaneous species/subspecies (64 of which are alien) and 35 cultivated taxa, belonging to 401 genera and 99 families. It should be noted that some species reported in the literature for the Tarsia area are, strictly speaking, actually present in adjacent areas (among the most relevant examples: *Fritillaria messanensis* Raf. subsp. *messanensis*).

The most represented families are Asteraceae (90 taxa), Poaceae (66 taxa) and Fabaceae (61 taxa), while the richest genera are *Trifolium* (18 taxa), *Euphorbia* (10 taxa), *Silene* (8 taxa), *Ophrys* and *Plantago* (7 taxa each).

From a chorological perspective, the Mediterranean geographic element is predominant (43%), followed by widely distributed (18.5%) and Eurosiberian taxa (15.5%), with 10% of taxa having a distribution spanning both the Mediterranean and Eurosiberian regions. Italian endemic species account for 2.8% of the flora, while alien species represent 10.2%. Regarding life forms, therophytes prevail (39.2%), followed by hemicryptophytes (28.6%), geophytes (14.7%), phanerophytes (12.8%), chamaephytes (3.1%), and hydrophytes (1.6%).

Among the taxa of particular phytogeographical and conservation interest are the Italian endemics *Artemisia campestris* L. subsp. *variabilis* (Ten.) Greuter, *Crocus biflorus* Mill., *Daucus broteroi* Ten., *Euphorbia corallioides* L., *E. meuselii* Geltman, *Gelasia villosa* (Scop.) Cass. subsp. *columnae* (Guss.) Bartolucci, Galasso & F.Conti, *Gypsophila arrostoi* Guss. subsp. *arrostoi*, *Micromeria consentina* (Ten.) N.Terracc., *Onobrychis alba* (Waldst. & Kit.) Desv. subsp. *echinata* (G.Don) P.W.Ball, *Ophrys incubacea* Bianca subsp. *brutia* (P.Delforge) Kreutz, *Ornithogalum exscapum* Ten., *Picris scaberrima* Guss. (described from the Tarsia area; see Astuti et al. 2015; Fig. 1), *Salvia haematodes* L., *Silene echinata* Otth, *Stipa austroitalica* Martinovský, *Thalictrum calabricum* Spreng., and *Visnaga crinita* (Guss.) Giardina & Raimondo. Unfortunately, the latter species is locally extinct and never found again after 1827 (NAP-GUSS!).

The taxa with the highest frequency of observation in the area are: *Oloptum thomasii* (Duby) Banfi & Galasso (162), *Artemisia campestris* subsp. *variabilis* (155 records), *Daucus carota* L. subsp. *carota* (140), *Avena barbata* Pott ex Link (139), *Dittrichia viscosa* (L.) Greuter subsp. *viscosa* (127), *Anethum foeniculum* L. (117), *Cynodon dactylon* (L.) Pers. (108), *Picris hieracioides* L. subsp. *hieracioides* (99), *Quercus pubescens* Willd. subsp. *pubescens* (95), and *Ferula communis* L. subsp. *communis* (86) among native species; *Erigeron canadensis* L. (81), *Arundo donax* L. (77), *Opuntia ficus-indica* (L.) Mill. (73), *Sorghum halepense* (L.) Pers. (70), and *Robinia pseudoacacia* L. (44) among alien species; *Olea europaea* L. (111),

Prunus amygdalus Batsch (54), *Eucalyptus camaldulensis* Dehnh. (34), *Vitis vinifera* L. (28), and *Nerium oleander* L. subsp. *oleander* (8) among cultivated taxa.

Four species documented by herbarium specimens have not been confirmed, and could be possibly extinct at the local level: besides the above-mentioned *Visnaga crinita*, *Euphorbia aleppica* L. (CLU!) *Lotus angustissimus* L. (NAP-GUSS!), and *Trifolium ligusticum* Balb. ex Loisel. (NAP-GUSS!).

Discussion

The species richness of the established flora (native plus naturalized and invasive aliens) is 25% below expectations, while aliens are 11% below the expected. Both these data could be explained by the low environmental variability and high degree of human disturbance of the study area. The low number of species could, in part, also be due to undersampling in some areas. The Map of Relative Floristic Ignorance highlights the cells that are best known on floristic grounds (Fig. 2). The cells near the northern and south-western border of the municipality show the highest relative floristic ignorance, and more intensive studies in these areas may change the picture.

On phytogeographical grounds, the area clearly shows a Mediterranean affinity, considering both chorological and biological spectra, with 43.3% of Mediterranean taxa and a H/T ratio of 0.73.

Among the taxa recorded for the study area, 34 are included in the Red List of the Italian Flora (Rossi et al. 2013, 2021; Orsenigo et al. 2021): 21 were assessed as Least Concern, 8 as Data Deficient (among which the Italian endemics *Euphorbia meuselii*, *Gypsophila arrostoi* subsp. *arrostoi*, and *Picris scaberrima*), 4 as Near Threatened (*Artemisia campestris* subsp. *variabilis*, *Onobrychis alba* subsp. *echinata*, *Silene echinata*, *Squilla pancration* Steinh.), 1 as Vulnerable (*Dracunculus vulgaris* Schott), 1 as Endangered (*Fritillaria messanensis* subsp. *messanensis*), and 1 as Critically Endangered (Possibly Extinct) (*Visnaga crinita*).

There are also species that are rare in Calabria, such as *Lophiolepis scabra* (Poir.) Del Guacchio, Bureš, Iamonico & P.Caputo, *Isoëtes durieui* Bory, *Myosurus minimus* L., *Notobasis syriaca* (L.) Cass., *Ornithogalum refractum* Kit. ex Willd., *Ranunculus sceleratus* L., and *Spirodela polyrhiza* (L.) Schleid., as well as species otherwise typically associated with coastal environments, such as *Artemisia arborescens* (Vaill.) L. and *Atriplex halimus* L., both occurring on the cliffs below the town of Tarsia. *Chenopodium ficifolium* Sm. and *Orobanche cernua* Loefl. are new records for the region.

Finally, concerning aliens, noteworthy is the presence of 18 invasive alien taxa, some of which are particularly widespread. Among alien taxa, two are included in the list of invasive alien species of Union concern under the European regulation UE 1143/2014 and the application regulations UE 2016/1141, 2017/1263, 2019/1262, 2022/1203, and 2025/1422: *Ailanthus altissima* (Mill.) Swingle and *Reynoutria japonica* Houtt., the latter so far only cultivated.

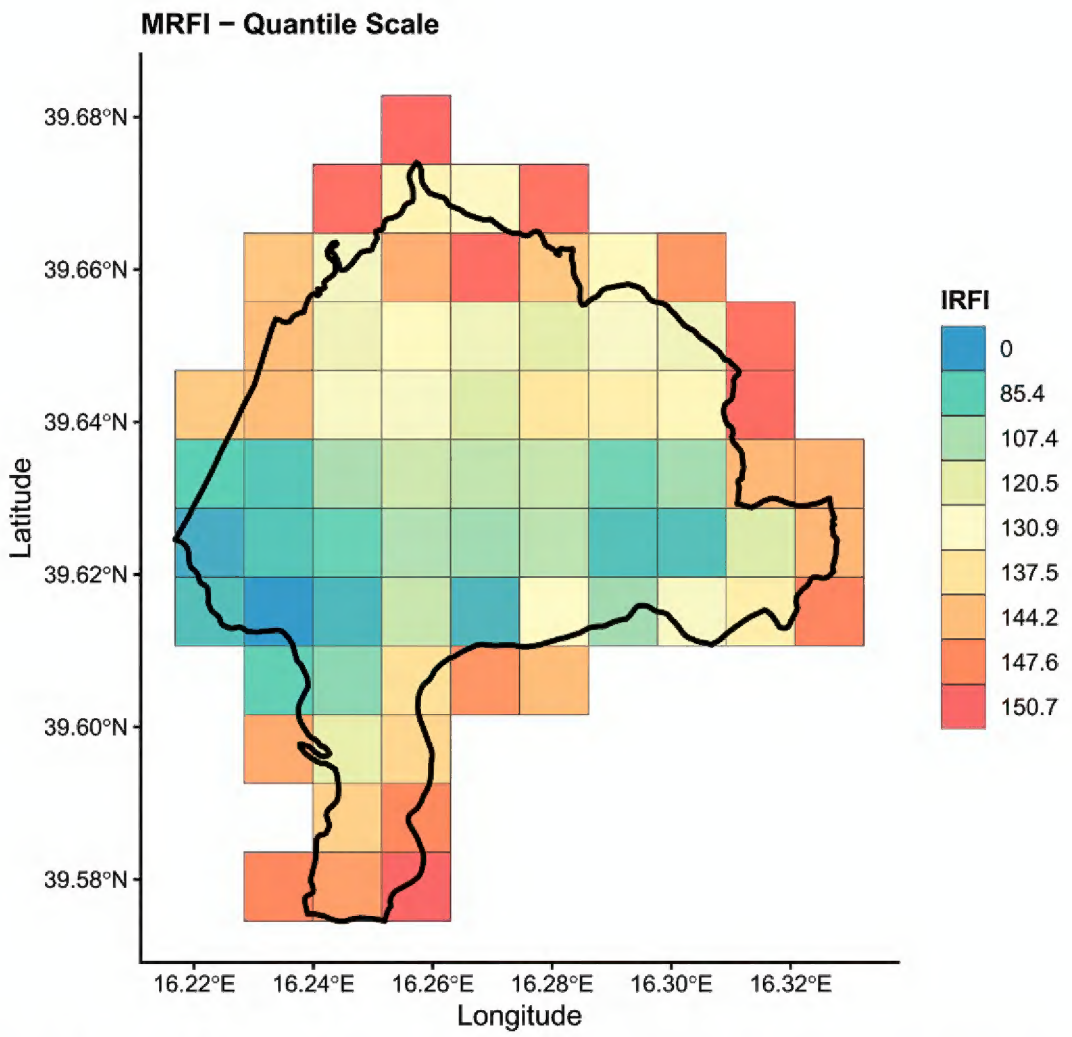

Figure 2. Map of Relative Floristic Ignorance of the municipality of Tarsia (province of Cosenza, Calabria, southern Italy), computed with a cellsize = 1000 m and a temporal coefficient tau = 20. The colour scale represents values of Index of Relative Floristic Ignorance (IRFI), ranging from 0 (blue) to a maximum value (red) representing the cells showing lowest and highest relative ignorance, respectively. Coordinates are projected in EPSG 3035: ETRS89/ETRS-LAEA.

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Supplementary material 1

Additional information

Authors: Lorenzo Peruzzi

Data type: pdf

Explanation note: 1. Floristic list and records. 2. References cited in the supplementary material.

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